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by:

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### **Force Measurements in Vibration and Acoustic Tests**

The advent of triaxial, piezoelectric force gages and the associated signal processing has opened the door to several dynamics testing innovations. This new technology is being applied in the CASSINI and other spacecraft programs that JPL manages for NASA, with considerable international participation. These applications of force measurements have generated a number of analytical developments and topics for further research.

Force limiting is a proven application. Shake input forces and moments are now routinely measured and controlled in JPL random vibration tests. Inflight, aerospace equipment mounted on lightweight structure, acts like a vibration absorber and generates a large reaction force to reduce the input motion at antiresonance frequencies. Limiting the input force in the vibration test to that predicted for flight, minimizes overtesting and overdesign. New analytical techniques for predicting inflight force limits from structural impedance and modal effective mass have been developed.

Base-drive and acoustic modal testing is a potential application. Modal information recovered from base-drive and acoustic tests of the CASSINI spacecraft, mounted on a dynamic force gage system, will be evaluated against that obtained in the conventional fixed-base modal test of the spacecraft structural model to see if a separate modal test can be eliminated in future spacecraft programs. Relevant experience in the international community is solicited.